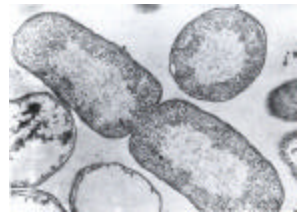# Bacteria Background

- Indicator bacteria good correlation with gastrointestinal illness (much better than fecal coliform), EPA Bacteria Criteria 1986

- Beach Act (Beaches Environmental Assessment and Coastal Heath Act of 2000)

- EPA Disapproved VA fecal criterion 2000

- Effective January 2003, Criteria developed for primary recreation uses for *E. coli* for freshwater and enterococci for saltwater and transitional waters (monthly geo mean, SSMax)

- Phasing out of fecal coliform standard by 2008

- Effective Feb 2004, Secondary Contact Criteria but no waters identified
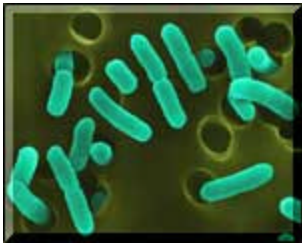
Bacteria
9 VAC 25-260-160 and 170

- **Bacteria; shellfish waters**

  – Fecal Coliform (14 geo.mean 43-49 90th %)

- **Bacteria; other waters**

A. In surface waters, except shellfish waters ….. the following criteria shall apply to protect primary contact recreational uses:

  1. Fecal coliform bacteria shall not exceed a geometric mean of 200 fecal coliform bacteria, 2 or more sample calendar month, not more than 10% during any month exceed 400 …….This criterion shall not apply… after the bacterial indicators …have a minimum of 12 data points or after June 30, 2008, whichever comes first.

Bacteria
9 VAC 25-260-160 and 170

Bacteria; other waters

A.2.	Geometric Mean[1]	Single Sample Maximum[2]
E.Coli (fresh)	126	235
Enterococci (salt)	35	104

[1] Two or more samples calendar month.

[2] No single sample maximum shall exceed a 75% upper one-sided confidence limit based on a site-specific log standard deviation. If site data are insufficient to establish a site-specific log standard deviation, then 0.4 shall be used as the log standard deviation in freshwater and 0.7 shall be as the log standard deviation in saltwater and transition zone. Values shown are based on a log standard deviation of 0.4 in freshwater and 0.7 in saltwater.

B. Notwithstanding the above, all sewage discharges shall be disinfected to achieve the applicable bacteria concentrations in subsection A 2 of this section prior to discharge.

Bacteria
EPA Guidance

- FAQ Sheets (August 2006) Clarifying EPA Interpretation of 1986 Criteria in Light of 2004 Beach Act Rule

- Use of Single Sample Maximums and Geometric Means

- Risk Levels

- Other Interpretations per the 2004 Beach Act Rule

EPA Guidance
Single Sample Maximum vs Geometric Mean

- Geometric Mean the more environmentally relevant endpoint

- SSMs must be used for making daily decisions in beach monitoring, notification and closure

- States may decide how to use SSMs in other CWA applications (e.g., 303(d) listing)

EPA Guidance
Geometric Mean Duration

- 1986 Criteria and 2004 Beach Rule gives States discretion on geometric mean duration
- EPA says 30-day or seasonal OK

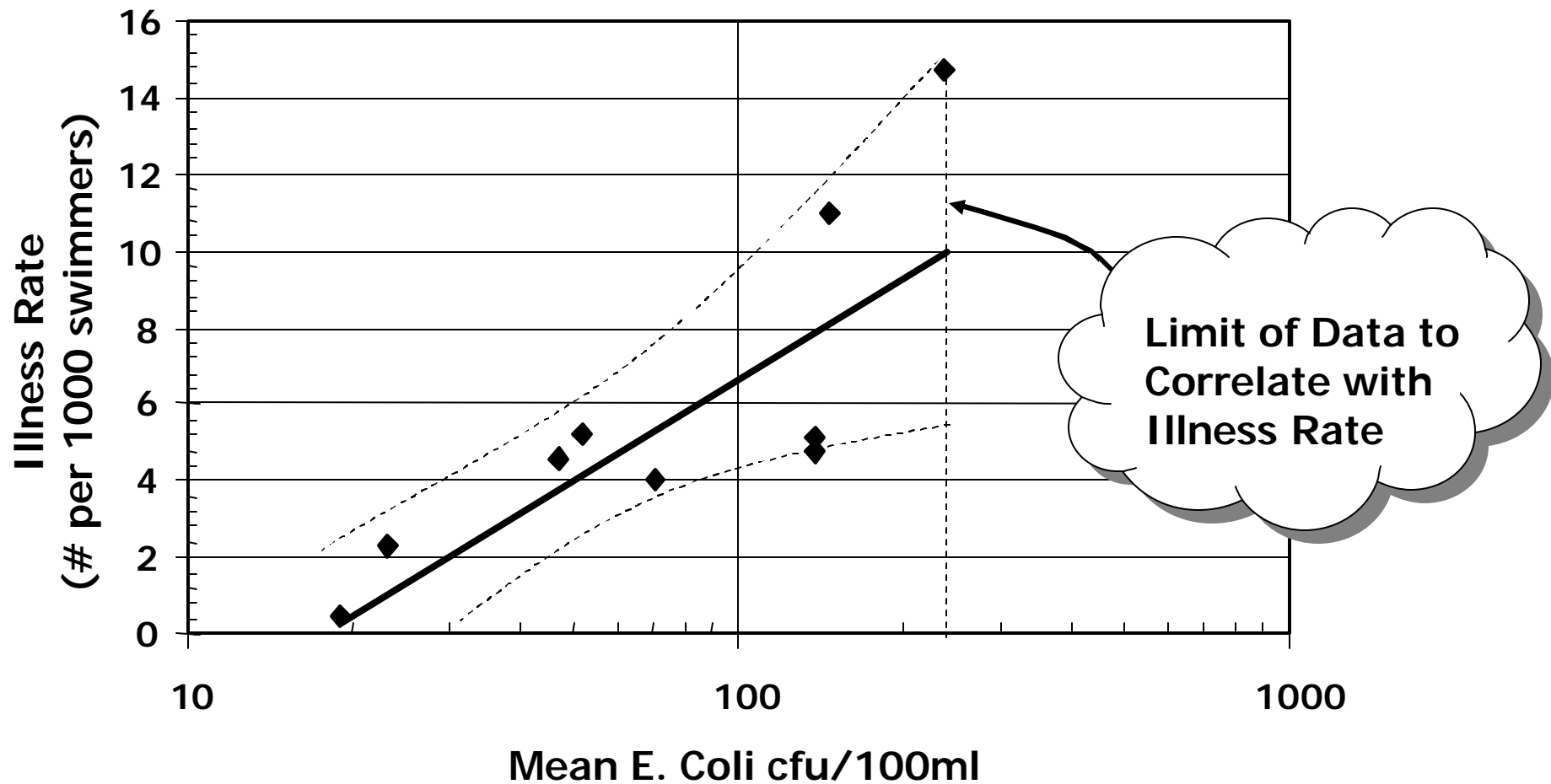# Single Sample Max as Percentiles Example using E. coli

Indicator	Geometric Mean Density (per 100 mL)	Single sample maximum (per 100 mL)			
		Designated beach area (upper 75% C.L.)	Moderate full body contact (upper 82% C.L.)	Lightly used full body Contact (upper 90% C.L.)	Infrequently used full body contact (upper 95% C.L.)
E. Coli FW	126	235	298	409	575
Enterococci FW	33	61	78	107	151
Enterococci SW	35	104	158	276	501

EPA Guidance
Illness Rates

Risk Level (% of swimmers)	Geometric Mean Density (per 100 mL)	Single sample maximum (per 100 mL)			
		Designated beach area (upper 75% C.L.)	Moderate full body contact (upper 82% C.L.)	Lightly used full body Contact (upper 90% C.L.)	Infrequently used full body contact (upper 95% C.L.)
0.8	126	235	298	409	575
0.9	161	301	382	523	736
1.0	206	385	489	668	940

E. Coli and Illness Rates

Illness Rate (# per 1000 swimmers) vs **Mean E. Coli cfu/100ml**

Limit of Data to Correlate with Illness Rate

EPA Guidance
Human vs. Non-Human

- Beach Rule (2004) states that the bacteria criteria apply regardless of origin unless a sanitary survey shows sources are non-human AND an epidemiological study shows the densities are not indicative of a human health risk.

DEQ Needs
Assessment, TMDL

- Clarify how the bacteria maximum and geometric mean are to be interpreted (e.g. if both the bacteria max and mean apply)

- Discuss how the SSM and mean apply to other water programs (assessment, TMDL, beach monitoring)

- Allow a fixed rate percent (e.g. 10%) to define allowable excursions

- Discuss illness rates (risk levels) for recreational criteria

- Discuss the averaging period (e.g. 30-day, calendar month, seasonal or annual).

Water Assessment Programs

Program	Frequency of Data Collection	Criteria Used to Assess Use
Beaches (VDH)	Weekly	**VDH uses SSM for closures/advisories (no allowable non-attainment but resample)** **DEQ uses G.M. for 303(d) impairment listing (2-hits = impaired, beach and/or advisory and closure information)**
Inland Waters (DEQ)	Variable 1/mo. Or bimonthly	SSM > 10.5% = impairment listing 2-hits = impairment in small datasets (**2-9 samples)**
TMDL (DEQ)	Model generated daily values	**SSM and G.M. = O% impairment (100% attainment)**

DEQ Needs Assessments, TMDL

- Clarify recreation bacteria criteria also apply in shellfish waters

- Remove fecal coliform criterion for recreational use (keep *E. coli* and enterococci)

- Discuss wet weather or CSO impacted waters.

DEQ Needs
Permitting in Shellfish Waters

- Fecal Coliform 14/100

- Fecal Coliform 90th percentile shall not exceed 49/100)

- Clarify WQBEL for sewage discharges VPDES into shellfish waters = 200 g.m. fecal coliform (for DSS model)